STRUCTURE OF NEUTRON-RICH Cr ISOTOPES: INADEQUACY OF THE fp MODEL SPACE AND THE ONSET OF DEFORMATION*

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The full $\pi f_{7/2}\nu fp$ model space is small enough for large-scale calculations to be performed and new effective interactions within it have been developed recently [1]. These interactions have had some success in descriptions of low-lying excited states in neutron-rich fp-shell nuclei near N=28, such as the weakening N=32 subshell closure with increasing Z. However, predictions of an N=34 subshell closure do not appear to be substantiated by experiment [2]. Knowledge of excited states has, so far, been unavailable towards the midshell region, and the effective interaction and the extent of the applicability of the model space have not yet been tested extensively. The strength of the N=40 gap and the influence of the $g_{9/2}$ orbital, with its potential to induce deformation, have therefore not been investigated fully.

The low-lying levels in ^{59,60}Cr have been studied with the ^{13,14}C(^{48}Ca,2p) reactions at a beam energy of 130 MeV, using Gammasphere in combination with recoil measurements using the Fragment Mass Analyzer and a segmented-anode ion chamber. The residues of interest were selected and identified on the basis of *A/q*, energy-loss and time-of-flight measurements. This is the first time that multiple charged-particle channels have been isolated in this region.

Data on ^{59}Mn, produced via the pn-evaporation channel from reactions on a ^{13}C target, have set limits on the spin of the ground state in ^{59}Cr, enabling some spin-parity assignments of excited states to be made. The structure of ^{59}Cr obtained in this study is clearly inconsistent with results of shell-model calculations within the full fp shell and requires inclusion of the $\nu g_{9/2}$ orbital. The sequence of states is understood within Nilsson model calculations assuming a moderate oblate ground-state deformation. Results of a recent experiment to study ^{60}Cr produced in reactions on a radioactive ^{14}C target will also be discussed in terms of the development of deformation into the midshell region.

Multiple charged-particle emission may prove to be a useful technique for studying other neutron-rich nuclei. Other examples of the possible use of the 2p channel will be discussed, as well as the feasibility of isolating 3p residues.

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